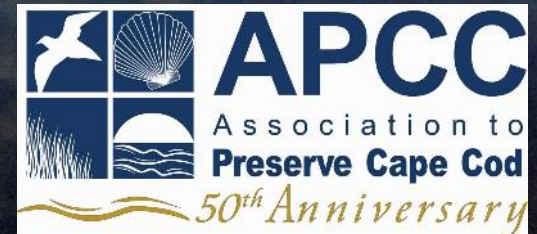


# Protecting and Restoring Freshwater Ponds of Cape Cod

Brewster Ladies Library  
February 22, 2018

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Restoration Ecologist  
Association to Preserve Cape Cod





# Presentation Outline:



- ◇ Pond Basics Review
- ◇ Pond Problems
- ◇ Preventing Problems
- ◇ Restoration Options

# Intro to Cape Cod Ponds



- ◇ ~1000 lakes and ponds on Cape!
- ◇ Most are kettle ponds (glacial)
- ◇ Some man-made (dams)
- ◇ Some joined the sea (salt ponds)



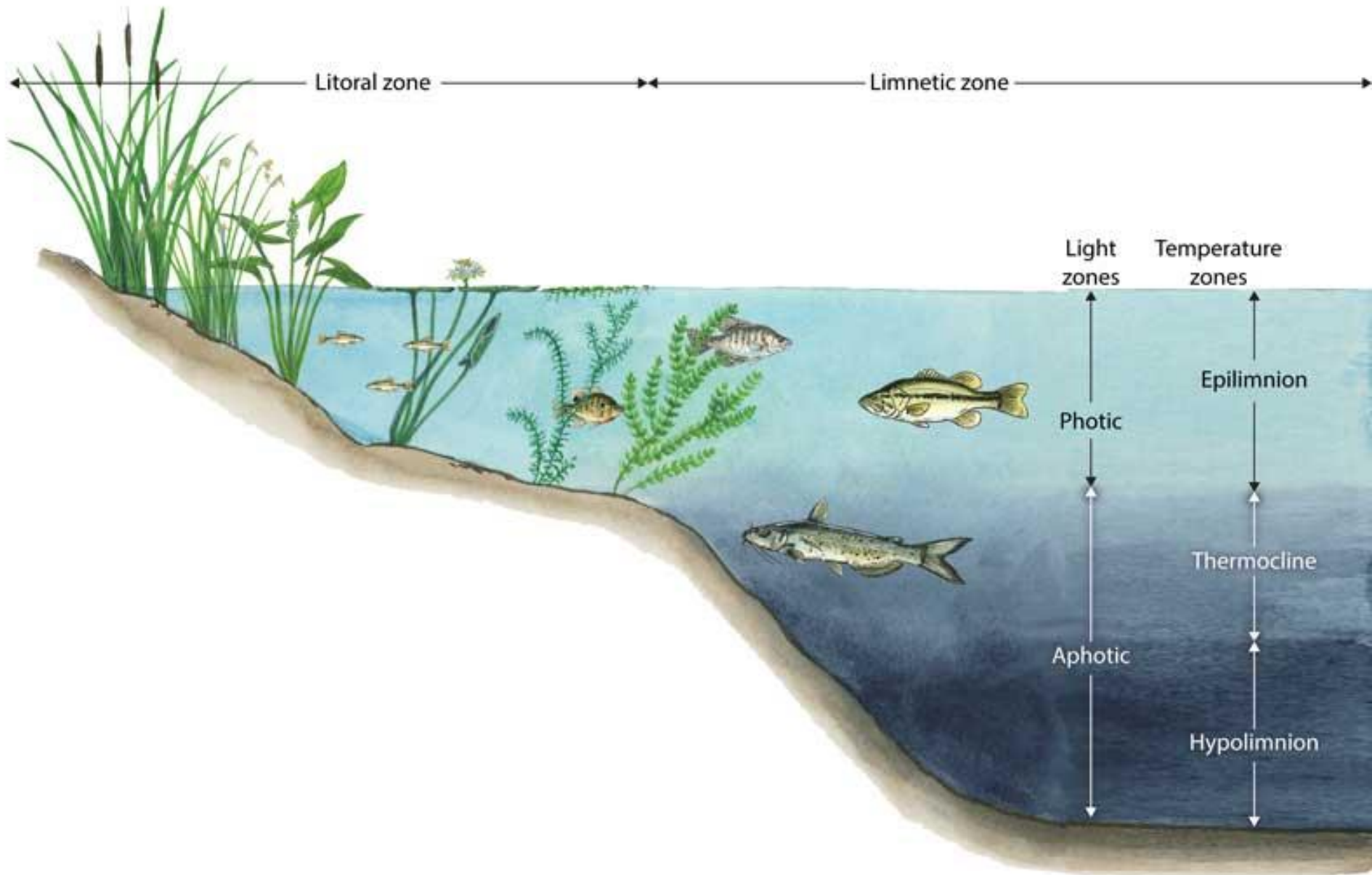
# Pond Life-Cycle



- ◇ Birth: formation of a depression – filled with water.
- ◇ Life: filling with sediment, organic matter, nutrient enrichment (eutrophication).
- ◇ Death: filled-in and transition to a wetland.



# Pond Zones

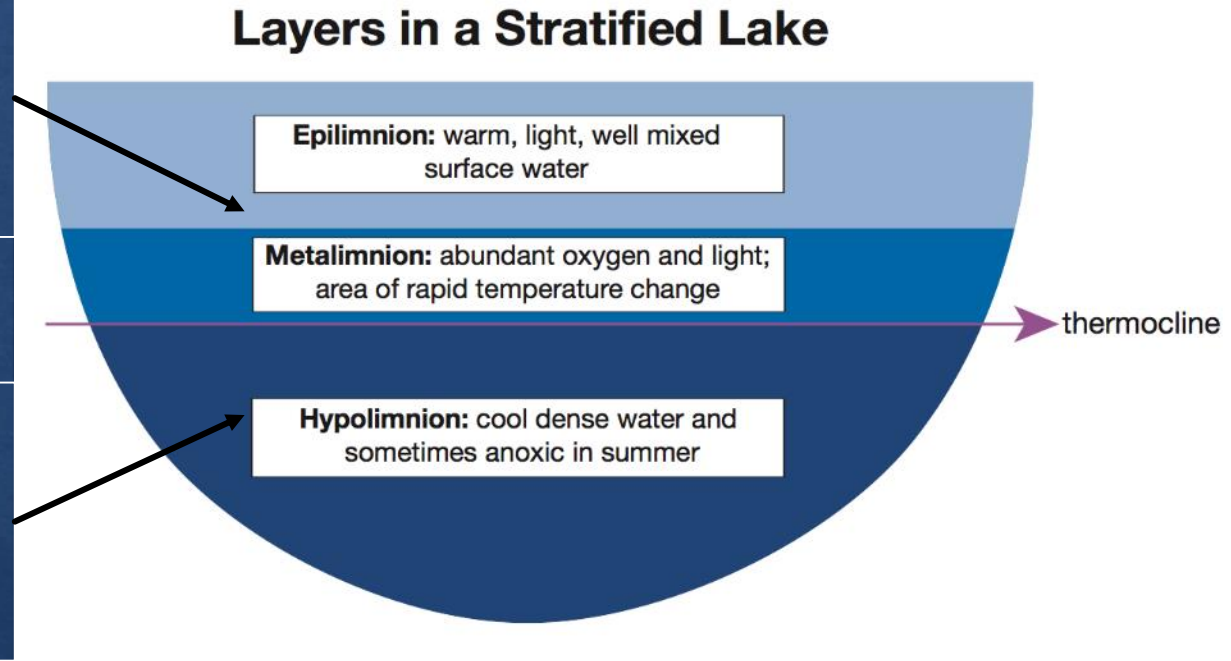




# Deep Ponds

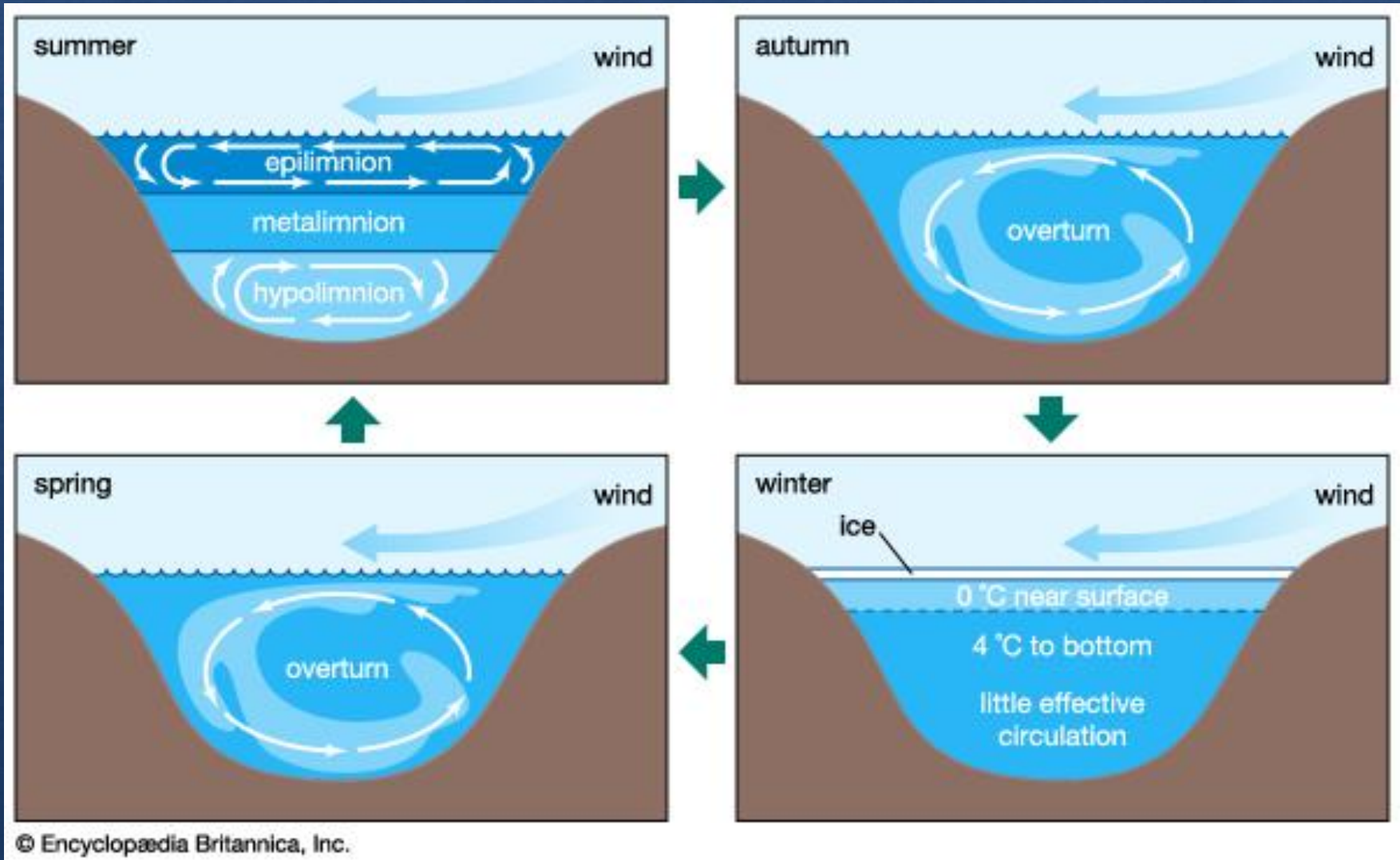
- primary production
- photosynthesis
- +oxygen
- nutrient uptake

- decomposition
- respiration
- -oxygen
- nutrient release





# Cycle of Stratification & Mixing





# Shallow Ponds

- ◊ Widespread plant growth
- ◊ Lack stratification
- ◊ Frequent mixing
- ◊ Warmer water has lower oxygen saturation capacity
- ◊ Daily cycle of oxygen production and consumption (low DO early am)
- ◊ If anoxia develops sediments can leach nutrients
- ◊ Algal blooms block light and reduce oxygen output from plants
- ◊ Algal decomposition (respiration) absorbs more oxygen





# Pond Problems

- ◆ Algal and Cyanobacterial Blooms (HABs)
- ◆ Low Dissolved Oxygen (anoxia)
- ◆ Nutrient Enrichment (eutrophication)
- ◆ Bacteria and Pathogens
- ◆ Other Pollutants (metals, pesticides, etc.)
- ◆ Invasive Plants and Animals
- ◆ Habitat Degradation
- ◆ Loss of Native Species
- ◆ Temperature Changes
- ◆ Water Level Extremes
- ◆ Loss of Connectivity



# Why do we have pond problems?



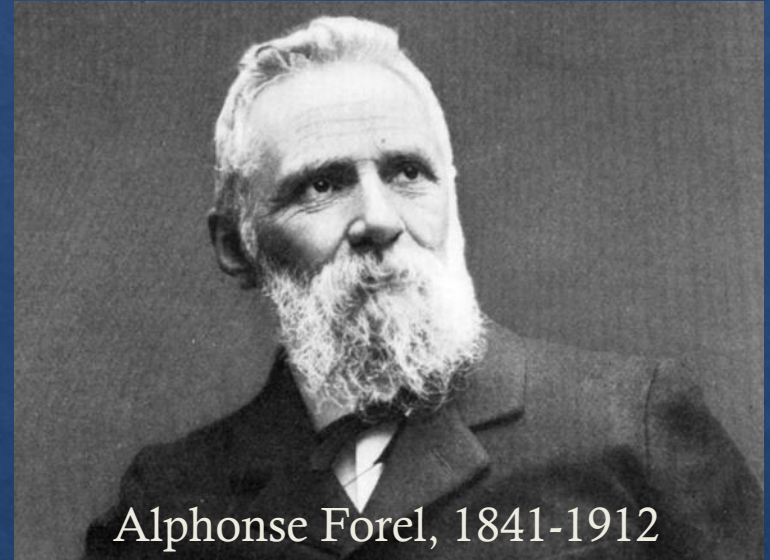
- ◇ Development/ land management = flow restrictions, water withdrawal, habitat destruction, stormwater & groundwater pollution.
- ◇ Fossil fuel usage = air pollution & atmospheric deposition.
- ◇ Climate change =  $\Delta$  temperature, precipitation, water level.
- ◇ Introduction of invasive aquatic plants and animals.
- ◇ Natural life cycle of pond



# Understanding Ponds: Limnology

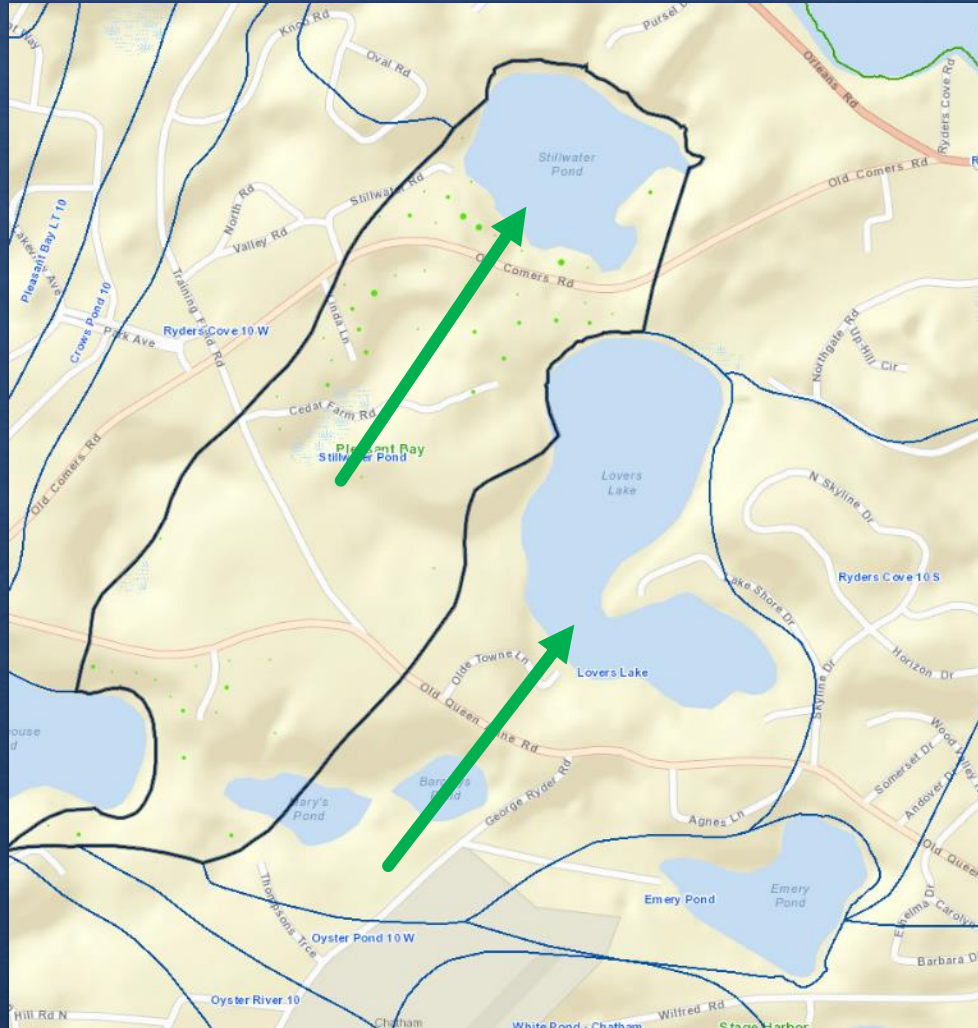
A multidisciplinary approach is required to gain a holistic understanding of pond function, health, and restoration needs:

- ◊ Geology
- ◊ Geography
- ◊ History
- ◊ Physics
- ◊ Biology
- ◊ Chemistry



Alphonse Forel, 1841-1912

# Pond Watersheds





# Steps for Restoration

1. Identify a Problem (Monitoring)
2. Determine the Cause
  - ◇ Hypotheses
  - ◇ Assessment/Testing/Modeling
3. Develop a Management Plan or Strategy
  - ◇ Targeted at Source of Problem
4. Preparation: Planning, Permitting and Outreach
5. Implementation
6. Monitoring



# Solutions

- ◆ Prevention! – Protect our Pristine Ponds
- ◆ Restoration – To Improve Impaired Ponds
- ◆ How to protect and restore: reducing nutrients, managing invasive plants, and restoring habitat
- ◆ Before Take Action: Examine Risk vs Benefit





# Nutrients

## Sources:

- ◆ Development (degradation of natural habitat in pond watershed)
  - ◆ Fertilizer
  - ◆ Wastewater
  - ◆ Stormwater
- ◆ Atmosphere
- ◆ Sediments (not an original source but the place where things pile up)



# Algal Blooms

- ◆ Causes:
  - ◆ Excess nutrients
  - ◆ Warm temperature
- ◆ Effects:
  - ◆ Blocks light
  - ◆ Depletes oxygen
  - ◆ Harm to organisms (fish, mussels, aquatic plants...)
  - ◆ Toxicity to humans and animals.
  - ◆ Smelly, slimy, degraded ponds.





# Cyanobacteria in Brewster Ponds



Walker's Pond Bloom

August 29, 2017



Upper Mill Pond Bloom

September 26, 2017



# Prevention – Nutrient Impairment

Prevention Starts at the Source

- ◆ **Fertilizers and Chemicals**
- ◆ Septic Systems
- ◆ Stormwater Runoff

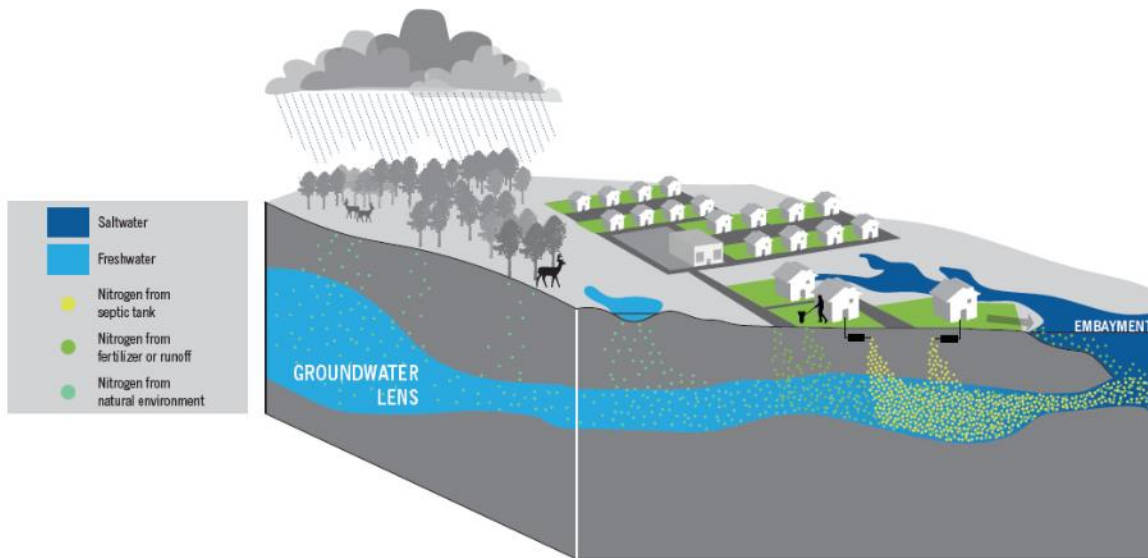
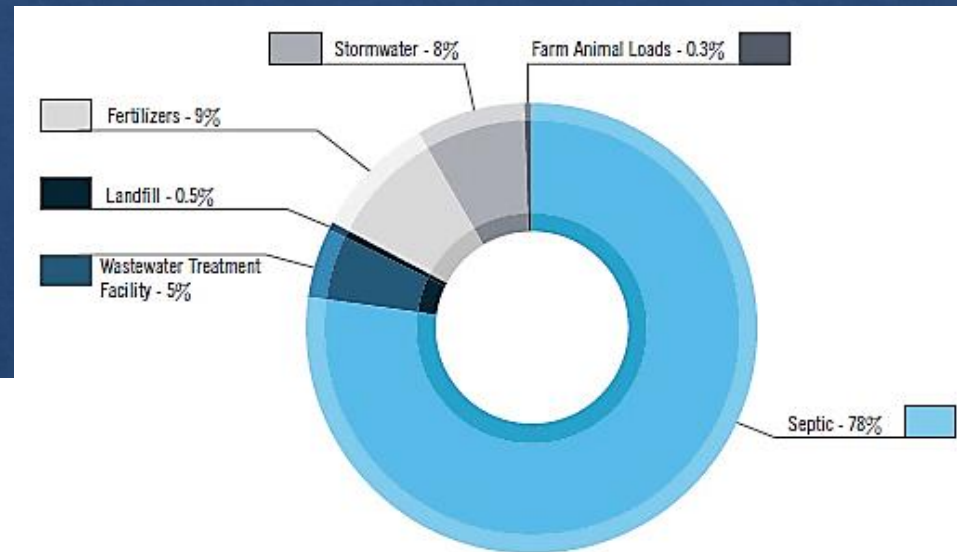




# Prevention – Nutrient Impairment

## Prevention Starts at the Source

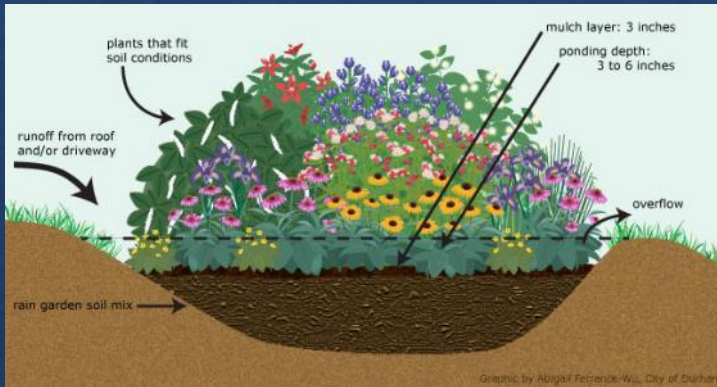
- ◇ Fertilizers and Chemicals
- ◇ **Septic Systems**
- ◇ Stormwater Runoff



# Prevention – Nutrient Impairment

## Prevention Starts at the Source

- ◆ Fertilizers and Chemicals
- ◆ Septic Systems
- ◆ **Stormwater Runoff**





# Restoration: Nutrient Impaired

- ◆ **Nutrient Source Reduction: Chemicals, Wastewater, Stormwater**
- ◆ **Short-Term Methods to Reduce Nutrients in Pond:**
  - ◆ Phosphorus Inactivation (aka Alum Treatment)
  - ◆ Artificial Circulation (example: Solar Bee)
  - ◆ Dredging
  - ◆ Dilution or Flushing

# Restoration: Nutrient Impaired

## “Phosphorus Inactivation” (aka Alum Treatment)

- ◇ Long Pond, Brewster/Harwich
- ◇ Lovells Pond, Barnstable
- ◇ Lover's Lake, Chatham

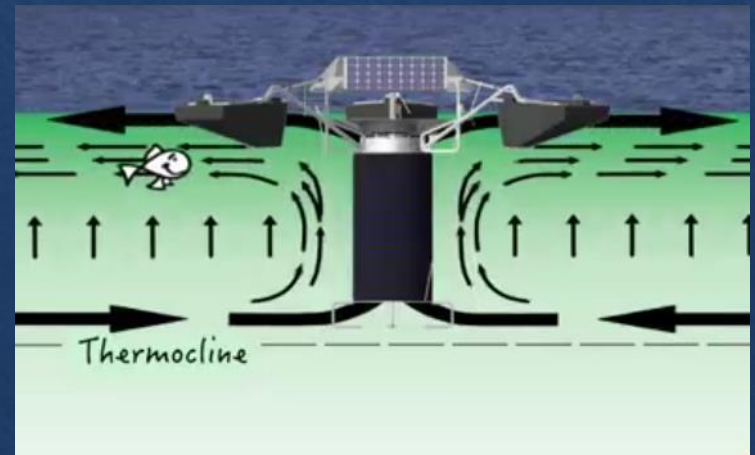




# Restoration: Nutrient Impaired

## Artificial Circulation

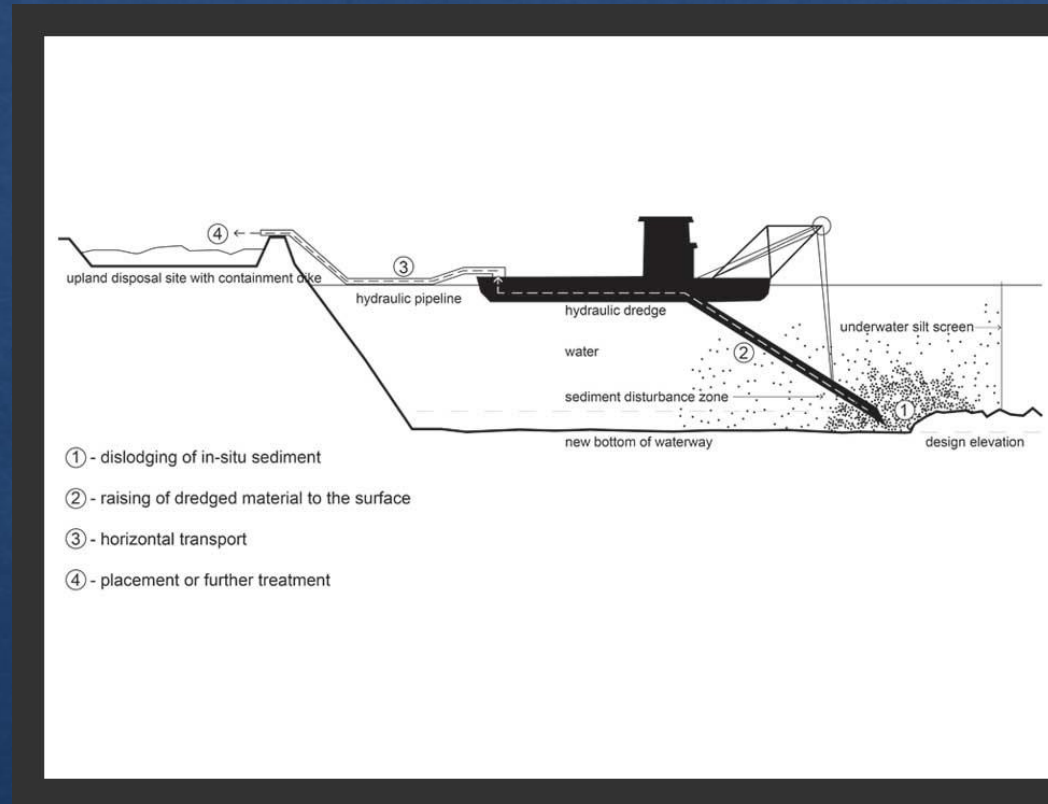
- ◇ Solar Bee – Santuit Pond, Mashpee  
Installed six – Total Cost \$350,000



# Restoration: Nutrient Impaired

## Dredging

- ◇ Dry
- ◇ Wet
- ◇ Hydraulic or Pneumatic

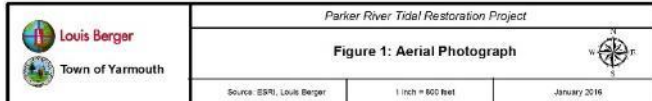




# Restoration: Nutrient Impaired

## Dilution or Flushing

- ◆ Increased water flow (inlet/outlet) to dilute or flush out excess nutrients





# Muddy Creek Restoration

- ◇ Tidal Restoration
- ◇ Improve water flow
- ◇ Flush nutrients





# Common Aquatic Invasive Plants of Massachusetts



Eurasian Milfoil



Phragmites



Curly-leaved Pondweed



Fanwort



European Naiad



Purple Loosestrife



Water Chestnut



# New Invaders

- ◆ Hydrilla
- ◆ South American Waterweed
- ◆ Parrot Feather



Source: Roberta Hill, VLMP © 2007



# Prevention - Invasives

Best method of control is prevention!

## Boaters

- ◆ **CLEAN** off boats, trailers, anchors and gear
- ◆ **DRAIN** live well, bait and cooling water away from shore after each use
- ◆ Wash with hot water and **DRY** before enter another body of water
- ◆ Never release a species into water unless it came from that water



**CLEAN + DRAIN + DRY  
YOUR BOAT**



# Prevention - Invasives

Best method of control is prevention!

## Everyone

- ❖ Never dump aquarium or water garden contents into a water body
- ❖ Learn to ID exotic species
  - ❖ DCR free color guide
  - ❖ Weed Watchers program
- ❖ Share information
  - ❖ Request free “Stop the Spread of Invasive Species” sign for your boat ramp



Yellow floating heart



# Restoration Techniques: Managing Aquatic Plants

- ◆ Manual harvesting
- ◆ Benthic barriers, dyes or surface covers
- ◆ Herbicides
- ◆ Biological controls
- ◆ Water control (“ drawdown”)
- ◆ Dredging

# Harvesting Aquatic Plants





# Barriers to Photosynthesis

Limit Light to Reduce Plant Growth:

- ◊ Benthic Barrier
- ◊ Dye
- ◊ Surface Cover



# Herbicides to Control Aquatic Plants



Oyster Pond, Falmouth





# Biological Controls

Most common - Using Fish or Insects to Eat Plants

Examples:

- ◇ Eurasian Milfoil - American Weevil
- ◇ Purple Loosestrife – European Beetles



# Water Level Control and Dredging

Winter Drawdown





# Restoration Techniques: Water Flow and Connectivity

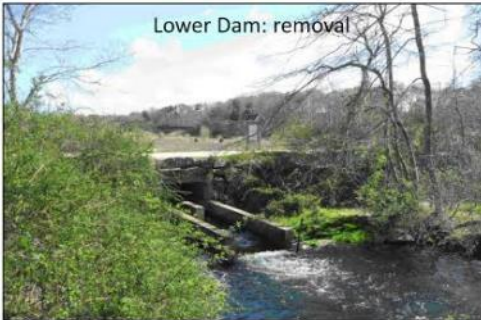
John Parker Road Culvert: design and permitting to replace with a bridge or similar



Middle Dam: removal



Lower Dam: removal



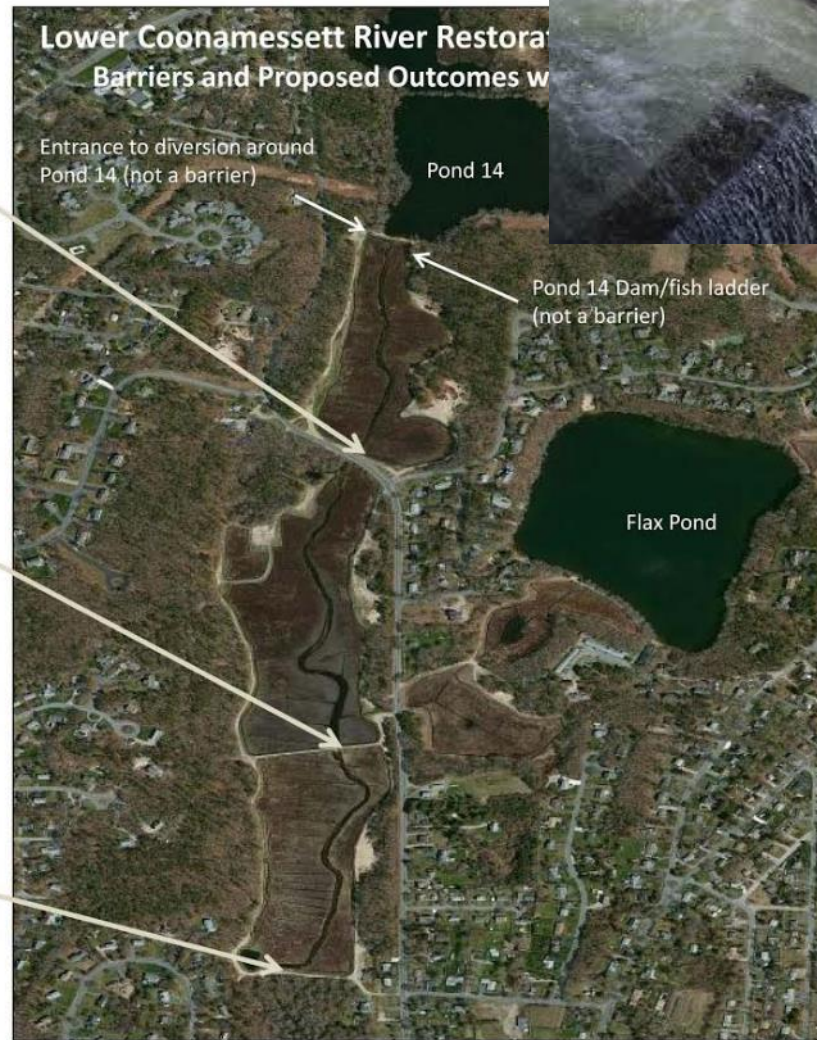
Lower Coonamessett River Restoration  
Barriers and Proposed Outcomes w

Entrance to diversion around  
Pond 14 (not a barrier)

Pond 14

Pond 14 Dam/fish ladder  
(not a barrier)

Flax Pond





# Case Study: Mystic Lake

- ◆ Detection of Hydrilla in 2010
- ◆ DCR worked with team to remove manually using raking and benthic mats (effective methods if detect early)



*IPA volunteers Bob and Alex Frazee, Betsey Godley, Don Houghton, Bob Nichols, and Lew Solomon raking Hydrilla inside the seine net. Not pictured: John Kayajan and Annette Nichols.*

The barriers are easily visible in shallow water, 2–4 ft deep, and must not be disturbed or moved out of position.



*A benthic barrier deployed over an area where Hydrilla was removed. **These barriers must not be disturbed or moved.***



# Case Study: Mystic Lake

- ◆ Detection of Hydrilla in 2010
- ◆ DCR worked with team to remove manually using raking and benthic mats (effective methods if detect early)
- ◆ Pond treated with Alum
- ◆ Next year: Spread of Hydrilla
- ◆ Now: Herbicides



Note: Walker's Pond example where pond was so murky weeds didn't grow! Improving clarity results in greater plant growth!

# Permitting

- ◆ Wetland Protection Act protects 100ft buffer zone around lakes and ponds or 200ft buffer zone around rivers
  - ◆ Activities that “**alter a Wetland Resource Area**” require filing of a NOI with MA DEP
  - ◆ Local Conservation Commission review and issue Order of Conditions
- ◆ Other Potential Permits if Pond:
  - ◆ Is Designated Critical Habitat
  - ◆ Contains Endangered Species
  - ◆ Is a Source of Drinking Water





# What You Can Do to Help

- ◆ Join your local pond or watershed group
- ◆ Assist with research and monitoring
- ◆ Reduce your impact! Prevention!
- ◆ Support town projects and funding requests to manage the problem and restore your ponds
- ◆ Become an APCC member, sign up for our email list, follow us on Facebook
- ◆ Attend CCNH Conference at CCCC on March 17



# Messages

## 1. Each pond is unique

- ◇ But many similar features

## 2. “Problems” don’t always require action

- ◇ Natural pond life cycle

## 3. Manage at the watershed scale

- ◇ Don’t just look in the pond

## 4. Best approach

- ◇ Address problem at the source

## 5. Be proactive!

- ◇ Promote education and stewardship



# Resources

- ◆ Massachusetts Department of Conservation and Recreation (DCR) Lakes and Ponds Program
  - ◆ Brochures and Information
  - ◆ Weed Watcher Program – training to ID invasive plants
  - ◆ Lakes and Ponds Guide
  - ◆ GEIR (General Environmental Impact Report on Lakes and Ponds) or Companion Practical Guide
  - ◆ Boat Ramp Monitoring Program info – signs for posting
- ◆ Cape Cod Commission Ponds: Project map tour
- ◆ Cape Cod Commission “Black Box”: technologies for wastewater management



Thanks for listening!

Questions?

